

forms which I can find to have been described from this region. It is a more delicate and inflated species than either *variabilis* C. B. Adams or *vidleri* Sowerby, if I am correct in my determination of these forms, and not at all close to either. It seems to be nearest to the *O. barborensis* Dall, but the latter is much more compact, more solid, and more highly tinted, as well as usually of considerably smaller size. While it is possible that the relatively thin callus on the lip is indicative of immaturity, another large specimen which has come to my notice from the San Pedro Channel agrees in this as in every other particular.

A figure will appear on a plate of this volume.

THE CONJUGATION OF *ARIOLIMAX CALIFORNICUS*.

BY HAROLD HEATH.

The newly hatched young of *Ariolimax californicus* measure approximately five eighths of an inch in length, and under favorable conditions become from three to three and a half inches long at end of four months. Full-sized adults, measuring in the neighborhood of eight inches, probably reach such dimensions in not over ten months. A three-inch individual possesses all of the essential features of the adult, though the constituent organs of the reproductive system are of small size.

For several years the specimens of this species that are used for class dissection at Stanford University have been collected from a nearby and comparatively circumscribed area along the San Francisquito creek where the conditions throughout are uniform. It was therefore surprising to find that annually fully five per cent of the large-sized animals dissected in the classroom lacked the penis entirely, while in an equal number it was abnormally undeveloped when compared with that of smaller individuals which had not yet reached sexual maturity. As the years went by the conviction became stronger that at some previous time the penis in all such specimens had been cast off, and that its diminutive proportions in otherwise fully formed animals represented a regenerative stage.

To test the correctness of the hypothesis fully two hundred

animals were placed in an enclosure, and were fed for several weeks. Preliminary steps in the reproductive process (the so-called *Liebspiel*) were noted on several occasions, but evidently complete union never took place since no young were produced. More definite information, therefore, was sought in the field, but conjugation evidently takes place at night since on two days only—and those dark and gloomy in the early morning—was the act witnessed.

Prior to the act of conjugation each individual viciously bites the side of its mate (faced in the opposite direction), then violently retracts the head which gradually is protruded before the next onslaught. The intensity of this first phase gradually lessens as the bodies become curved about each other, thus finally bringing the genital papillae in contact. The penis of one individual only is then inserted, and after a period of several hours the two animals commence to draw apart. In both of the observed cases, when the penis had become exposed to the extent of about half an inch, one of the animals turned its head and commenced to gnaw upon the walls of the organ. These biting movements were unusually vigorous, and therefore in marked contrast to those witnessed during the feeding process but practically identical with those in the initial stages of conjugation, and within ten minutes had so scotched the penial walls that the exposed portion had stretched to an inch in length. The other animal (subsequent dissection in one case showed it to be the possessor of the intromittent organ concerned) now took part in the process, and within a very few minutes the penis was entirely severed.

All four of the animals were subsequently killed and dissected. In two of the individuals the gnawed-off penis extended from the genital pore through the proximal section of the oviduct to the distal, blind end of the seminal receptacle. The walls of the oviduct were in a high state of contraction, and only with the greatest care was it possible to dissect out the penis without destroying the surrounding tissue. In the other two specimens the penis was wholly absent, and the vas-deferens extended to the genital pore—a condition of affairs exactly duplicated in some of the other animals examined on previous occasions in

the laboratory. As no other cases of conjugation were encountered it has not been possible to determine whether the penis regenerates or not, though I am firmly convinced that it does.

Whether this act of mutilation invariably takes place is not known, and the significance of the process is far more obscure. It is possible the amputated penis may act as a plug to retain the spermatozoa in the seminal receptacle, or on the other hand it may be that the presence of a human observer or some natural enemy brings with it unusual conditions, such as jarring the earth or some specific scent, and that the severing of the intromittent organ is a provision whereby the animals are enabled to separate more rapidly than usual. The fate of the penis is likewise unknown; it evidently is either absorbed or, what is more likely, is cast out before the eggs pass to the exterior.

NOTES.

POLYGYRA ALBOLABRIS MAJOR AND P. A. FUSCOLABRIS.—Clapp mentioned that you wanted to examine the animal of *Polygyra albolabris major* Binn. I happened to have one. So send it. The form ranges through Southern Alabama and I have found it as far north as Wetumpka. In Central and Northern Alabama the common large southern form of *albolabris* is pretty generally distributed, though not very common: some specimens approach *major* in size.

“The form which you called *P. albolabris fuscolabris* is as far as I know confined to the Cumberland Plateau and outlying masses (Monte Sano etc.) in Madison and part of Jackson Cos. Judging by the shells alone, I should be very much inclined to call this a distinct species. Ordinarily it is flatter than *albolabris* and always it can be easily distinguished by its peculiar luster as if varnished lightly: this is due to microscopic sculpture. Some of our specimens are larger than the average *major*. By the way, you must have had a specimen which was not quite mature: in full-grown shells the lip is white and the body of the shell is rather dark brown.”—HERBERT H. SMITH.

Having dissected the specimen of *P. a. major* sent, I find it identical with *P. albolabris* anatomically, and its status as a subspecies rather than a distinct species is therefore confirmed.—

H. A. PILSBRY.